REMARKS

Claim 41 has been amended. Accordingly, claims 29-38, 40-44, and 46-50 are pending in the present application. Claims 30, 40, and 46 were previously withdrawn. The status of the claims set forth in the Office Action dated January 25, 2007, is as follows:

(A) Claims 29, 32-35, 37, and 38 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,082,207 ("Tulinius"); and

(B) Claims 29, 31-38, 41-44, and 47-50 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,293,110 ("Middleton").

As a preliminary matter the undersigned wishes to thank Patent Examiner Holzen for participating in an Examiner Interview on April 17, 2007. During the interview, the Tulinius and Middleton references were discussed. Additionally, the parties discussed U.S. Patent No. 6,431,498 ("Watts"). The parties tentatively agreed that, with the clarifying language that has been added to claim 41, the claims are patentable over the cited references pending further review and consideration. This paper constitutes the applicant's summary of this interview. If the Examiner notes any deficiencies with regard to this summary, the Examiner is encouraged to contact the undersigned attorney.

A. Response to Section 102 Rejections Based on Tulinius

Independent claim 29 and 35 were rejected under 35 U.S.C. § 102 as being anticipated by Tulinius. As described below, the rejection of these claims should be withdrawn because Tulinius does not teach or suggest all of the features of these claims.

1. Claim 29 is Directed Toward an Aircraft System that Includes a Leading Edge Device Arrangement, Wherein a Leading Edge Device Chord Length at Each of a Plurality of Spanwise Locations is at Least Approximately Equal to the Smallest Leading Edge Device Chord Length Required to Provide a Local Maximum Lift Coefficient

Claim 29 is directed toward an aircraft system that includes an airfoil having a spanwise portion. The spanwise portion has a plurality of spanwise locations. The system further includes a leading edge device arrangement coupled to the spanwise portion. The leading edge device arrangement includes at least a portion of at least one leading edge device. The at least one leading edge device in turn includes at least a portion of a leading edge flap or leading edge slat. A leading edge device chord length at each of the plurality of spanwise locations is at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack.

2. Tulinius Discloses a System for Controlling an Aircraft Through Aeroelastic Deflection of the Wings

Tulinius discloses a system for controlling an aircraft through aeroelastic deflections of the wings in all modes of flight (col. 2, lines 25-35). Movement of the leading edge and trailing edge wing control surfaces bring about the aeroelastic deflections of the flexible wings for control of the aircraft, optimum cruise, and specific maneuvers (col. 2, lines 25-35). The system can also effect gust load alleviation, flutter suppression, and maneuver load control (col. 2, lines 25-35).

3. Tulinius Fails to Teach or Suggest, Among Other Features, a Leading Edge Device Arrangement, Wherein a Leading Edge Device Chord Length at Each of a Plurality of Spanwise Locations is at Least Approximately Equal to the Smallest Leading Edge Device Chord Length Required to Provide a Local Maximum Lift Coefficient

As discussed in the May 23, 2006, Request for Continued Examination, Tulinius makes no reference to a leading edge device chord length at each of the plurality of

spanwise locations being at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient. In fact, Tulinius makes no reference to any leading edge device chord length. Accordingly, Tulinius does not teach or suggest a leading edge device chord length at each of the plurality of spanwise locations that is at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack.

Additionally, the above referenced Office Action does not claim that Tulinius discloses a leading edge device chord length at each of the plurality of spanwise locations that is at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack, as recited in claim 29. Instead, the Office Action suggests that the leading edge wing control surfaces in Tulinius have leading edge device chord lengths at leach location that are <u>capable</u> of corresponding to the smallest cord length required to provide a local maximum lift coefficient when the airfoil is operated at a specific design condition and angle of attack. This is not the standard for anticipation in the MPEP.

Section 2131 of the MPEP recites that a "claim is anticipated <u>only</u> if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference" (emphasis added). As discussed above, Tulinius makes no reference to any leading edge device chord length at all. Accordingly, Tulinius does not expressly or inherently describe a leading edge device chord length at each of the plurality of spanwise locations that is at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack, as recited in claim 29.

Furthermore, it would not be obvious to one skilled in the art to modify the leading edge wing control surfaces of Tulinius to have a leading edge device chord length at each of the plurality of spanwise locations that is at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack. As discussed in the May 23, 2006, Request for Continued Examination, and the Background section of the present application:

> The typical design process, which yields the design depicted in Figure 1, includes determining the amount of lift that the wing 1 must provide during various phases of flight, and an aircraft angle of attack that will be required to generate this lift. Because longer leading edge device chord lengths generally provide better high angle of attack performance, ***a leading edge device chord length that will support the required aircraft angle of attack on the critical portion of the wing 1 is determined. Generally, this leading edge device chord length determined for the critical portion of the airfoil is then used for all portions of all leading edge devices on the airfoil*** (i.e., each leading edge device has the same, constant chord length). Occasionally, a smaller chord length is used (for installation reasons) near the wing tip 17 due to spanwise wing taper or other structural constraints [emphasis added].

Accordingly, with current leading edge designs, local maximum lift coefficients (Cl_{max}s) generally do <u>not</u> occur at at least approximately the same angle of attack across a spanwise portion of the wing (i.e., all the spanwise locations don't stall at the same time). As discussed in the Background section of the present application, current leading edge designs are typically sized such that, as angle of attack is increased, Cl_{max} occurs at a single spanwise location. As angle of attack is increased further, that location of the airfoil becomes stalled (the angle of attack that produces Cl_{max} is exceeded) and the local value of the lift coefficient (Cl) at that location is reduced. However, local Cl_{max}s occurs at one or more other spanwise locations. In fact, with current systems, manufactures often add stall strips, vortex generators, and other aerodynamic devices to tailor the spanwise lift distribution at various angles of attack. As discussed above, there is nothing in Tulinius to

teach or suggest modifying the leading edge wing control surfaces of Tulinius to have a leading edge device chord length at each of the plurality of spanwise locations that is at least approximately equal to the smallest leading edge device chord length required to provide a local Cl_{max} when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack. Accordingly, one skilled in the art would not arrive at the claimed subject matter without the teachings of the present application and the use of impermissible hindsight.

The above referenced Office Action also states that "functional language in the claims do[es] not serve to impart patentability. While features of an apparatus may be recited either structurally or functional[ly], claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function." The undersigned respectfully disagrees.

As discussed in the May 23, 2006, Request for Continued Examination, the claim language in independent claim 29 is structural in nature, and even if the language were considered to be functional, the language is appropriate and patentable under 35 U.S.C. 112 and MPEP 2173.0(g). Claim 29 recites a leading edge device chord length at each of the plurality of spanwise locations that is at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack. The leading edge device and the plurality of leading edge device chord lengths recited in these claims are <u>structural</u> or <u>physical</u> elements.

Additionally, even if the foregoing phrase were considered to be functional in nature, according to MPEP 2173.0(g) there is nothing inherently wrong with defining some features of a claim using functional terms. The MPEP goes on to state that functional language does not, in and of itself, render a claim improper; a functional feature must be evaluated and considered, just like any other feature of the claim, for what it fairly conveys

to a person of ordinary skill in the pertinent art in the context in which it is used. The MPEP further states that a functional feature is often used in association with an element, ingredient, or step of a process to define a particular capability or purpose that is served by the recited element, ingredient or step. The MPEP goes on to provide examples of acceptable claim terms used to define structural attributes, including "operatively connected," "members adapted to be positioned," and "portions . . . being resiliently dilatable whereby said housing may be slidably positioned." Accordingly, the language in claim 29 complies with 35 U.S.C. 112 and must be evaluated and considered, just like any other feature of the claim, for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used.

For at least the foregoing reasons, Tulinius fails to provide adequate basis for a prima facia case of anticipation of claim 29 under Section 102. Claims 30-34 depend from claim 29. Therefore, for at least this reason, and for the additional features of these claims, claims 30-34 are also patentable over Tulinius. Claim 35 includes, *inter alia*, features similar to claim 29. Accordingly, for at least this reason, and for the additional features of this claim, claim 35 is patentable over Tulinius. Claims 36-38 depend from claim 35. Therefore, for at least this reason, and for the additional features of these claims, claims 36-38 are also patentable over Tulinius.

B. Response to Section 102 Rejections Based on Middleton

Independent claim 29, 35, 41, and 47 were rejected under 35 U.S.C. § 102 as being anticipated by Middleton. As described below, the rejection of these claims should be withdrawn because Middleton does not teach or suggest all of the features of these claims.

1. Middleton Discloses a System for Using a Vortex to Reduce Drag on a Wing

Middleton discloses a system for supersonic airplanes with highly swept-back, low aspect ratio wings that induces separation of the streamline flow, from the upper surface of

a deflected leading edge flap, through the utilization of a vortex generating means, such as: a counter-deflected, double-flap; a leading edge spoiler for a deflected flap; or a jet nozzle means (col. 1, lines 5-49). The Middleton system deflects the fore-flap, of a double leading edge type flap, in a direction opposite to convention, in order to induce a vortex flow for controlling the separation of the streamline flow from the upper surface of the remainder of the wing; and at the same time, suppress lower surface streamline flow separation behind the aft-flap at low angels-of-attack (col. 1, lines 5-49). An object of Middleton is to realize or increase the beneficial effect of a trapped vortex flow on the forward facing surface of a leading edge flap (col. 1, lines 5-49). Middleton asserts that this can decrease the drag of the wing, through increased effective leading edge suction brought about by low vortex-induced surface pressures acting on the forward facing surface of the flap (col. 1, lines 5-49). Figure 4A of Middleton shows a series of leading edge flaps tapered in the same direction (decreasing chord length from right to left) used for vortex generation.

2. <u>Middleton Fails to Teach or Suggest, Among Other Features, a Leading Edge Device Arrangement, Wherein a Leading Edge Device Chord Length at Each of a Plurality of Spanwise Locations is at Least Approximately Equal to the Smallest Leading Edge Device Chord Length Required to Provide a Local Maximum Lift Coefficient</u>

Middleton makes no reference to a <u>leading edge device chord length</u> at each of the plurality of spanwise locations being at least approximately equal to the smallest leading edge device chord length required to <u>provide a local maximum lift coefficient</u>. Although Middleton does disclose a step-tapered or saw-toothed leading edge for producing a spiral vortex to reduce drag (col. 1, lines 5-49; col. 5, lines 22-25), there is nothing in Middleton regarding a relationship between leading edge device chord length and maximum lift coefficients. Additionally, as discussed in the May 23, 2006, Request for Continued Examination, drag and lift are distinctly different aerodynamic forces. As a result, the techniques used to minimize drag can be significantly different than the techniques used to maximize lift. In fact, techniques used to maximize lift often cause an increase in drag.

Accordingly, Middleton does not teach or suggest a leading edge device chord length at each of the plurality of spanwise locations that is at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack.

Additionally, the above referenced Office Action does not claim that Middleton discloses a leading edge device chord length at each of the plurality of spanwise locations that is at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack, as recited in claim 29. Instead, the Office Action suggests that the leading edge flaps in Middleton have leading edge device chord lengths at leach location that are capable of corresponding to the smallest cord length required to provide a local maximum lift coefficient when the airfoil is operated at a specific design condition and angle of attack. As discussed above, this is not the standard for anticipation in the MPEP. Accordingly, because Middleton does not teach or suggest a leading edge device chord length at each of the plurality of spanwise locations that is at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack, claim 29 is not anticipated by this reference.

Furthermore, it would not be obvious to one skilled in the art to modify the leading edge flaps of Middleton to have a leading edge device chord length at each of the plurality of spanwise locations that is at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack. As discussed above and in the Background section of the present application, with current leading edge designs, local maximum lift coefficients (Cl_{max}s) generally do not occur at at

least approximately the same angle of attack across a spanwise portion of the wing and there is nothing in Middleton to teach or suggest modifying the leading edge flaps of Middleton to have a leading edge device chord length at each of the plurality of spanwise locations that is at least approximately equal to the smallest leading edge device chord length required to provide a local Cl_{max} when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack. Accordingly, one skilled in the art would not arrive at the claimed subject matter without the teachings of the present application and the use of impermissible hindsight.

For at least the foregoing reasons, Middleton fails to provide adequate basis for a prima facia case of anticipation of claim 29 under Section 102. Claims 30-34 depend from claim 29. Therefore, for at least this reason, and for the additional features of these claims, claims 30-34 are also patentable over Middleton. Claim 35, amended claim 41, and claim 47 includes, *inter alia*, features similar to claim 29. Accordingly, for at least this reason, and for the additional features of these claims, claims 35, 41, and 47 are patentable over Middleton. Claims 36-38 depend from claim 35, claims 40 and 42-44 depend from claim 41, and claims 46 and 48-50 depend from claim 47. Therefore, for at least this reason, and for the additional features of these claims, these claims are also patentable over Middleton.

The undersigned respectfully requests that claims 30, 40, and 46 be rejoined and allowed because, as discussed above, these claims depend from and are directed to non-elected species of allowable generic claims 29, 41, and 47, respectively.

In view of the foregoing, the pending claims comply with 35 U.S.C. § 112 and are patentable over the applied art. The applicant accordingly requests reconsideration of the application and a Notice of Allowance. If the Examiner has any questions or believes a

telephone conference would expedite prosecution of this application, the Examiner is encouraged to call the undersigned representative at (206) 359-6477.

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Respectfully submitted,

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